Title:	Optimizing Laboratory Curing Conditions for Hot Mix Asphalt to Better Simulate Field Behavior
The Problem:	Laboratory curing conditions (temperature and time) of loose mixes have substantial influence on mix engineering properties, such as stiffness, rutting, fatigue, and thermal cracking. This creates a significant impact on both mix design (binder content, gradation) and pavement structural thickness design. It is well-known that the mix engineering properties change after paving on the road. Generally asphalt mixes become stiffer, more rutting resistant, but less cracking resistant. These ever changing engineering properties make it very challenging to simulate field aging condition through laboratory curing of loose mixes. Previous research observed how engineering properties changed with time (aging). It was found that asphalt mix engineering properties changed dramatically within the first one or two years. After that, there were still some changes, but the changes were much slower. Meanwhile, it was concluded that the engineering properties of the fresh field cores or similar curing conditions (2 hr. laboratory curing at compaction temperature) could not be used for evaluating mix performance. Thus, the current short-term aging for simulating the plant producing and paving processes could not be used for simulating field aging and associated pavement performance. The current practice of using short-term aged mixes for cracking evaluation is based on the assumption that the relative performance of mixes does not change after long-term aging. Although some mixes may have excellent cracking resistance after short-term aging, they may still be susceptible to cracking in service. This may be particularly true for mixes that contain recycled materials including recycled asphalt pavement (RAP) and recycled asphalt shingles (RAS). Thus, it is critical to optimize laboratory curing conditions for asphalt mixes including those containing RAP and RAS to better simulate long-term field aging to understand the long-term cracking resistance of the mix. However, this has to be implementable and practical from the standpoint of obtaining the results in a short period of time. In addition to understanding what curing method is needed to address the long-term cracking resistance of asphalt mixtures including those containing RAP and RAS, there is also a need to understand how designing the mixture can lead to better long-term cracking resistance. This may include binders that have lower low temperature grades (e.g. -28), rejuvenators, increasing the asphalt content by adjusting gradations, and even considering increasing the lab molded density. This should also include investigating the physical and performance properties of the asphalt binder and how that relates to mix curing, because this may predict the cracking susceptibility of the mixture. While addressing the long-term cracking resistance, there is also a need to determine if the curing time and temperature stated in the specifications is valid to prevent early rutting of the mix. Therefore, two separate curing times and temperatures; one for cracking susceptibility and the other for rutting susceptibility, may be needed. Determining the optimum methodology for laboratory curing conditions in terms of long-term cracking and early age rutting also needs to utilize the concept of the balanced mix design. This may serve as the final link needed for the balanced mix design approach to ensure long lasting and durable asphalt pavements.

Technical Objectives:	The researchers shall address the following: 1. Conduct a detailed review of the current practices and standards used to age asphalt mixtures for the evaluation of cracking and rutting. 2. Recommend practical sample preparation procedures (equipment types, material handling, and oven requirements). 3. Develop practical laboratory curing conditions (temperature and time) for engineering properties (stiffness, rutting, and cracking resistance) of laboratory loose mixes. 4. Recommend practical laboratory curing conditions (temperature and time) for engineering properties (stiffness, rutting, and cracking resistance) of plant-produced mixes. 5. Compare the properties of laboratory aged to field aged samples. 6. Understand how designing the mixture impacts the short-term rutting resistance and long-term cracking resistance. 7. Investigate novel laboratory methods for asphalt binder to determine the effect of aging. 8. Understand curing effect on physical and performance properties of binders and how that relates to mix curing. 9. Develop revisions to current TxDOT test methods and specifications. The expectation of this project is that the end product will obtain a TRL level 8.
Desired Deliverables:	1. Technical memorandum for each task completed. 2. Monthly progress reports. 3. Value of Research (VoR) that includes both qualitative and economic benefits, to be included in the final research report. 4. Research report documenting the findings of the research, including recommendations to incorporate the influence of long-term aging on the cracking resistance of the mix. 5. Project Summary Report.
Proposal Requirements:	1. Utilize the “Proj/Agre” and “PA_Form” templates located at the TxDOT RTI website. 2. Proposals will be considered non-responsive and will not be accepted for technical evaluation if they are not received by the deadline or do not meet the requirements stated in RTI's University Handbook, which is also located at the RTI website. 3. Proposals should be submitted in PDF format, 1 PDF file per proposal. File name should include project name and university abbreviation. 4. This project will be tracked during the life of the project using a Technology Readiness Level (TRL) scale. For more information about the use of a TRL, click.